Osteoarthritis and Cartilage 18 (2010) 1363–1364

Osteoarthritis and Cartilage

Editorial

What semi-quantitative scoring instrument for knee OA MRI should you use?

Keywords:
Osteoarthritis
Magnetic resonance imaging
Semi-quantitative scoring

S U M M A R Y

Multiple techniques have been used to assess synovial morphology and change on MRI in OA. Broadly speaking these methods are divided into quantitative and semi-quantitative methods[1]. Quantitative measurements use computer-aided image processing to assess joint quantification (cartilage morphometry, bone volume, bone marrow lesion volume, meniscal position and volume, synovial volume, etc). In contrast to quantitative measures, semi-quantitative image analysis is typically much more observer dependent and generates grades or scales rather than truly continuous output. Multiple methods for semi-quantitative multi-feature assessment of the knee using conventional MRI acquisitions exist[2–5]. These instruments provide for broad assessment of the whole joint and derive from knowledge from reading as to what joint features are morphologically abnormal. They are labour- and expertise-intensive compared to more automated methodologies. As a consequence of their reader dependence, precision and reliability results have not been as favourable for these instruments as their quantitative cousins. These instruments are generally based on past perceptions of what should be considered an important feature and therefore can bias future research. This said they do provide an important tool especially when quantitative methodologies are lacking or have their own inherent limitations.

The two most widely used scoring instruments, Whole-Organ Magnetic Resonance Imaging Score (WORMS) and Boston Leeds Osteoarthritis Knee Score (BLOKS) are compared in a two-part series of manuscripts utilising Osteoarthritis Initiative (OAI) data[6,7]. The work is timely as large epidemiologic studies and clinical trials are maturing to the point where large scale scoring is commencing, and it is unclear at this point which of these instruments is more psychometrically sound. Identifying their relative merits and weaknesses will inform the optimal measures to apply in forthcoming studies. Part 1 assesses the agreement between these methods and the reliability of the scoring[6]. Part 2 compares their sensitivity to detecting change and validity[7].

It is important to reflect on the development of these instruments as this pair of manuscripts is not the start of this story. WORMS was developed cognizant of the potential of magnetic resonance imaging (MRI) to provide a measure of all potentially relevant synovial structures given the understanding of knee osteoarthritis (OA) as a disease of whole joint[4]. Analyses of these scores highlighted issues including: non-unidimensionality of items (where more than one construct may be included in a given item, for example, measuring features such as “synovosis” (effusion and synovitis combined) cartilage morphology breadth, depth and signal intensity in one single score); problems with the scaling of items, especially in “early” OA cohorts where only the lower end of scales may be used; and concerns about responsiveness[8,9]. Emanating from these limitations, work was undertaken to develop BLOKS[5]. Both instruments have been widely disseminated and used, although the number of direct comparisons of the two instruments is quite limited[5].

The pair of manuscripts in the current issue of Osteoarthritis and Cartilage extends that prior work. The MRI readings for these studies have been done by two readers with recognized expertise in this area utilising the well-described sequences available in the OAI. The sub-sample of OAI participants only includes persons with definite OA and some joint space narrowing (JSN) so is not generalizable to early or late disease. In the Part 1 manuscript[6], much of the discussion is only weakly substantiated by data presented in the manuscripts, e.g., advocating for multiple anatomic subregions in WORMS, suggesting dropping BLOKS bone marrow lesions (BML) adjacency score as there is discordance with size. The ultimate conclusion is that they both have high reliability, and there is little to differentiate them on assessing prevalence and severity of common features.

The Part 2 manuscript similarly has a number of limitations, and again, much of the discussion suffers from a lack of supportive evidence in the form of hard data[7]. Radiographic JSN is an inadequate standard to compare with cartilage morphology measures on MRI[10], and a more appropriate construct for comparison would have been quantitative cartilage morphometry. The lack of sample range for many of the features meant that there were no knees without BMLs to assess the full breadth of each scale. Despite demonstrating a clear relation of alignment to BLOKS cartilage scoring and the clear limitations of radiographs as a comparable construct, no differentiation is afforded either cartilage score.

The authors do not provide a clear indication that one instrument as a whole is preferable to the other, with certain strengths and weaknesses identified in each instrument. Ultimately the manuscript concludes with a helpful summation allowing the

1063-4584/$ – see front matter
doi:10.1016/j.joca.2010.10.011

reader to discern the authors' preferred measures for meniscus and bone marrow lesions. It is important to note that both scoring systems also score other features that are not included in these analyses such as synovitis, effusion, osteophytes, loose bodies, cysts/bursae, etc. Depending upon the intent of the study, the discerning investigator will need to choose from a complex array of measures from the two different instruments.

These recent analyses will likely inform the next evolution of scoring instrument/s for OA. Based upon the data presented in these paired manuscripts, the next iteration of scoring instrument will include some features from both. Ideally, these modifications to existing instrument/s will occur before large-scale scoring exercises commence in studies including the OAI. Ultimately, the measurement properties of these modifications themselves will need to be assessed to ensure their credibility. Since modifications are too frequently made to these tools with either absent or inadequate description, it is critical that any modifications made to these instruments be adequately described in published literature to allow those in the field an opportunity to ascertain their validity and to attempt replication.

Semi-quantitative scoring has and will continue to provide important insights into the etiopathogenesis of disease as well as structure–function relationships. As new insights continue to develop the field, the scoring instruments used to assess structural change will similarly need to evolve.

Conflict of interest

DJH was involved in the development and validation of BLOKS. SZ was involved in the development and validation of WORMS and is employed by Synarc who provides semi-quantitative reading services. TJM serves as a paid consultant for Kensey Nash Corporation.

Statement of work

The editorial was written by DJH. All authors were involved in editing and approving the final manuscript.

Support

DJH is supported by an Australia Research Council Future Fellowship.

References

1. Guermazi A, Burstein D, Conaghan P, Eckstein F, Hellio Le Graverand-Gastineau MP, Keen H, *et al*. Imaging in osteoarthritis. Rheum Dis Clin North Am 2008;34:645–87.
2. Biswal S, Hastie T, Andriacchi TP, Bergman GA, Dillingham MF, Lang P. Risk factors for progressive cartilage loss in the knee: a longitudinal magnetic resonance imaging study in forty-three patients. Arthritis Rheum 2002;46:2884–92.
3. Kornaat PR, Ceulemans RY, Kroon HM, Riyazi N, Kloppenburg M, Carter WO, *et al*. MRI assessment of knee osteoarthritis: Knee Osteoarthritis Scoring System (KOSS) – inter-observer and intra-observer reproducibility of a compartment-based scoring system. Skeletal Radiol 2005;34:95–102.
4. Peterfy CG, Guermazi A, Zaim S, Tirman PF, Miaux Y, White D, *et al*. Whole-Organ Magnetic Resonance Imaging Score (WORMS) of the knee in osteoarthritis. Osteoarthritis Cartilage 2004;12:177–90.
5. Hunter DJ, Lo GH, Gale D, Grainger AJ, Guermazi A, Conaghan PG. The reliability of a new scoring system for knee osteoarthritis MRI and the validity of bone marrow lesion assessment: BLOKS (Boston Leeds Osteoarthritis Knee Score). Ann Rheum Dis 2008;67:206–11.
6. Lynch JA, Roemer FW, Nevitt MC, Felson DT, Niu J, Eaton CB, *et al*. Comparison of BLOKS and WORMS scoring systems Part I. Cross sectional comparison of methods to assess cartilage morphology, meniscal damage and bone marrow lesions on knee MRI: data from the Osteoarthritis Initiative. Osteoarthritis Cartilage 2010;18:1393–401.
7. Felson DT, Lynch J, Guermazi A, Roemer FW, Niu J, McAlindon T, *et al*. Comparison of BLOKS and WORMS scoring systems part II. Longitudinal assessment of knee MRIs for osteoarthritis and suggested approach based on their performance: data from the osteoarthritis initiative. Osteoarthritis Cartilage 2010;18:1402–7.
8. Hunter D, Conaghan P, Peterfy C, Bloch D, Guermazi A, Woodworth T, *et al*. Responsiveness, effect size, and smallest detectable difference of magnetic resonance imaging in knee osteoarthritis. Osteoarthritis Cartilage 2006;14(Suppl 1):112–5.
9. Conaghan P, Tennant A, Peterfy C, Woodworth T, Stevens R, Guermazi A, *et al*. Examining a whole-organ magnetic resonance imaging scoring system for osteoarthritis of the knee using Rasch analysis. Osteoarthritis Cartilage 2006;14(Suppl 1):116–21.
10. Hunter DJ, Zhang YQ, Tu X, LaValley M, Niu JB, Amin S, *et al*. Change in joint space width: hyaline articular cartilage loss or alteration in meniscus? Arthritis Rheum 2006;54:2488–95.

D.J. Hunter*
Rheumatology Department, Royal North Shore Hospital and Northern Clinical School, University of Sydney, Sydney, NSW, Australia
* Address correspondence and reprint requests to: D.J. Hunter, Rheumatology Department, Royal North Shore Hospital and Northern Clinical School, University of Sydney, Sydney, NSW, Australia.
Tel: 61-2-9926-7379; Fax: 61-2-9906-1859.
E-mail address: David.Hunter@sydney.edu.au (D.J. Hunter)

S. Zaim
Synarc, 575 Market Street, 17th Floor, San Francisco, CA, USA

T.J. Mosher
Department of Radiology, Penn State University College of Medicine, Hershey, PA, USA